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WETLAND AVOIDANCE AND MINIMIZATION

Excerpts from a report presented by Walter L. Langlitz, Design Operations Engineer, at the Tacoma Wetlands Conference, Fall 1996

INTRODUCTION: A recent highway project in Montana serves to exemplify the role wetlands play in the statement of Purpose and Need and the selection of alternatives, how an alternative on new alignment is located to avoid wetlands, two examples of balancing wetland impacts with other resources, and general design considerations for minimizing wetland impacts.

PROJECT DESCRIPTION: The project is located in southwestern Montana west of Butte and Dillon. The 44± mile route was recently designated by the Forest Service (FS) as the Pioneer Mountains Scenic Byway. The road provides a north-south route from Wise River to Polaris through the Beaverhead National Forest. It provides access to and through the forest and is becoming a heavily utilized recreational route. It is a very scenic area and accesses many campgrounds and other forest attractions.

The primary purpose of the project is to upgrade the southerly 16 miles of the route which is gravel surfaced, to a standard two-lane road with a bituminous surface. The northerly 28 miles was reconstructed to a two-lane, paved surface in 1991. After 3+ years of project development, we just completed the Environmental Assessment (EA) for the project and are beginning the final design phase.

The southerly 12 miles of the route lie along the edge of the Grasshopper Valley at an altitude of approximately 6500 feet. Grasshopper Creek flows through the bottom of the valley and is flanked by irrigated wild hay meadows on either side. Willows line the stream channel. Cattle grazing and ranching operations have substantially impacted the riparian zones and adjacent wetlands.

ALTERNATIVES CONSIDERED: Two alternatives were considered for the last few miles of the project, as the road climbs from the valley through the forest.
Alternative F follows the existing road. This road corridor has been managed by the FS by retaining a view from the road of undisturbed forest (clear cuts or other disturbance that would be visible from the road have not been allowed). The road was constructed in the 1970's as a logging road with minimal geometrics. However, it was determined that the minimum design criteria for the reconstruction project (30 miles per hour, 24 feet wide) could be obtained along the corridor. It was realized the reconstruction would result in some large fills, and that some larger cuts would result in areas of steeper sidehill terrain. There were no wildlife concerns and no apparent wetland impacts. This was the only alternative carried forward in the National Environmental Policy Act (NEPA) analysis for the first two years of project development.

Alternative E is basically a new location, although it does follow some existing logging roads for a portion of its length. This area of the forest is managed for multiple use and includes clear cuts and mining activity, as well as snowmobile and cross-country ski trails, one of which is closely parallel to or under the new location. Much of the area east of the existing road is designated as an elk security area and is closed to motorized vehicles from mid-October to mid-May. The need to investigate this alternative developed late in the NEPA process due to a concern by the FS Regional Office that a more scenic alternative route was being overlooked. Considering the long-term vision for the scenic byway, the chance to relocate the road to another more scenic corridor would not likely occur in the future. The alternative was included very late in the NEPA process at some discomfort to the project level analysis team. The team knew there were likely to be substantial wildlife impacts and possible wetland impacts for the new alternative which did not occur along Alternative F.

The questions we wrestled with are these: Can and should Alternative E on new location be considered when it is known to have substantial wildlife and wetland impacts likely to be much in excess of those along Alternative F? How can we justify selection of Alternative E as a preferred alternative and expect to obtain a 404 permit for filling wetlands when we have acknowledged that Alternative F is "a practicable alternative" according to the COE 404(b)(1) guidelines?

I believe that the answer to the problem is contained in the Purpose and Need statement for the project's NEPA analysis. In general, the Purpose and Need statement is crucial in the NEPA documentation for the project, and should be the strongest part of the document. It sets the stage for the selection of alternatives, selection of the preferred alternative, and ultimately the justification for incurring environmental impacts as documented in the permitting process.

We did revise the Purpose and Need when Alternative E was added to the project. While we had focused initially on correcting the physical deficiencies and safety concerns of the project area, we opted to redefine the project in the broader context of the overall route with its designation as a national scenic byway. The purpose of the proposed improvements is to complete the upgrading of the Wise River-Polaris Road in order to: (1) enhance the scenic, recreational, educational, historic, and cultural opportunities of the Pioneer Mountains Scenic Byway Corridor, (2) better

accommodate the multiple uses of the National Forest and private interests along the route, (3) improve driving safety and driving convenience, and (4) make the road more maintainable.
With the addition of a scenic quality statement, we felt that the scenic quality of Alternative E could be a reason for its selection as the preferred alternative and the justification for obtaining a 404 permit for filling wetlands, **but only provided** that the scenic qualities available along the new location were substantially better than compared to those available along the existing road corridor. We realized that a compelling case would have to be made in both the NEPA documentation and the permit application.

So, how did the analysis turn out?
Except for one wetland, we were able to avoid impacts to most of the other wetlands along alternative E. Alternative E became much longer than F due to a massive active landslide and a substantial area of forested wetlands in the area which were extremely wet, creating the need to relocate around them.

The EA categorized wetlands by their classification, functional rating, and affected area for the E and F alternatives. All of the wetlands along these corridors are palustrine emergent, palustrine forested, or a combination of the two. Functional ratings were determined for relative food storage, sediment control, nutrient retention, relative habitat values, wildlife habitat value, and fisheries habitat value on a rating scale of Low, Medium, and High, and then combined for an overall rating. Almost all of the wetlands were rated as Low-Moderate. Alternative E impacted 1.9 acres while Alternative F impacted only 0.02 acres.

Engineering characteristics of the two alternatives were discussed in the EA. In almost all cases, Alternative F had lesser impacts due to its shorter length except for the surface areas of the 1.5:1 cut and fill slopes. In the final analysis, the scenic attributes of Alternative E were not judged to be substantially better than Alternative F. All factors pointed towards Alternative F which satisfactorily met the Purpose and Need for the project, and it became the preferred alternative. It should be noted that the impacts of bisecting the elk calving area with another road played a large part in the decision, along with the possibility of the presence of a Forest-sensitive species in the impacted wetland.

AVOIDANCE: I want to discuss wetland "avoidance," the first in order of preference of the three wetland regulation options (the second is minimization, the third, mitigation). From a design perspective, avoidance is also the first preference. Wetlands create problems for design and construction due to wet, unsuitable soils that usually require removal and replacement and subsequently drive up project costs. Without question, wetland mitigation and permitting are the largest headaches I have during the design process.

The general process for establishing an alignment on new location begins with establishing the typical section widths, design speed, and maximum grade allowed for the route. These criteria generally come from the American Association of State Highway and Transportation Officials (AASHTO) Green Book. The standards contained in this book have been adopted by the Federal Highway Administration (FHWA) for application by the various states to the nation's principal highway network.

Once the design criteria are established, a study of USGS quad sheets, uncontrolled aerial photos, and any other available information will lead to the identification of a general corridor that can be further explored on the ground. A flag line is established for an approximate corridor for field review of concerned agencies. It is at this point that an initial broad assessment of wetlands is made and the flag line adjusted as necessary to avoid them. Revisions are made until agreement is reached that a reasonable corridor has been established for survey purposes.

Because of special circumstances surrounding Alternative E (numerous wet areas, short time frame) we proceeded to have a consultant delineate wetlands for 328 feet on either side of the flag line according to the Corps of Engineers (COE) 1987 manual. The wetland boundaries were then surveyed along with the p-line survey and plotted on the mapping for the corridor before any alignment projection work started. Formal wetland delineation at this stage in the process may be earlier than many of you are accustomed to.

The next steps are to establish the centerline on the mapping using the design criteria and develop a preliminary design with approximate construction limits, carefully avoiding the delineated wetland areas where possible. A field review is then conducted with the concerned agencies, during which all impacts are considered and adjustments made as necessary, to reach a final alignment. This process may take several iterations until agreement is reached. The location of the flag line was considerably different than the final alignment. Without the actual wetland delineation, we would not have been able to position the alignment to be sure of avoidance. We were unable to avoid two wetlands due to grade and curvature restrictions. At these locations, we did shift the alignment up the drainage into an area that was already disturbed by mining activity and minimized the impact to the forested part of the wetland downstream of the proposed crossing.

IMPACT BALANCING: Obviously, there are other environmental, economic, and social concerns that must be considered in addition to wetland impacts. Balancing the impacts among the resources becomes a tricky art which will sometimes cause a wetland to be impacted when avoidance appears feasible. Examples include avoidance of historic properties, archaeological resources, private property concerns, section 4(f) properties, and cost. Each situation is unique. There is no set formula for determining the final course of action, and each individual case must be evaluated on its own merits.

Before I leave the subject of avoidance, I would say in general that we do a good job of avoidance and minimization but a very poor job of documenting how we did it. Specific documentation for these activities should occur when initial location activities begin, keeping in mind that the specific goal is to demonstrate avoidance and minimization at the time the permits are requested.

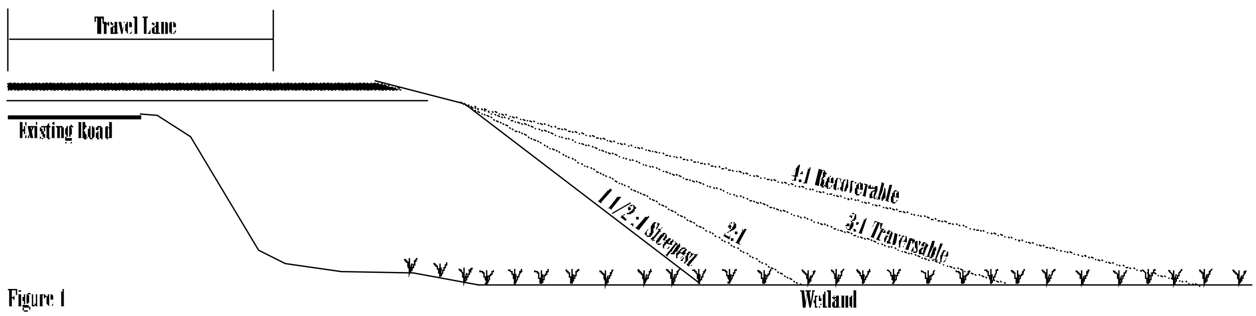

Figure 1

MINIMIZATION: Next, I want to discuss design issues related to minimization. In general, wetland impact minimization usually means a trade-off in some particular design element, usually safety or cost-related, or sometimes both. Typically, these include alignment revisions resulting in design exception curves, steeper cut/fill slopes, retaining walls, and bridges.

In the case of alignment, every situation is unique and must be evaluated against the design criteria for the project and the principles of driver expectancy. This is a whole field in itself, and I will just say that alignment revisions or introducing a design exception curve into an alignment to avoid a wetland impact have to be evaluated very carefully. What looks reasonable on the ground may not look the same on the mapping when considered in relationship to the adjacent alignment. Safety implications become paramount in these considerations.

Slope design also affects safety. The AASHTO Roadside Design Guide contains guidance for safety evaluation and application of the "clear zone" concept. The clear zone is an area adjacent to the travel lane that is free of obstructions and flat enough for an errant driver to return to the travel lane. The clear zone width varies with the type of road, from about 30 feet for higher-speed, higher-volume roads to about 10 feet for low-volume, low-speed roads. Slopes 4:1 or flatter are termed "recoverable slopes" and would be desirable for high-volume, high-speed roads such as the interstate system. Obviously, 4:1 slopes are not provided everywhere for numerous reasons. However, where possible, a 4:1 or flatter slope provides significant safety benefits. Clear zones also allow for considerable roadside impact. One possible way to provide the clear zone but minimize wetland impacts, is to steepen the slope after the clear zone width is provided. This is called a "barn roof" section.

Of course, another option to minimize wetland impact is to just steepen the slope. The 3:1 slope shown in Figure 1 is termed "traversable." If a vehicle strays onto the slope, it will not overturn but cannot recover as on the 4:1 slope. It will continue to the bottom of the slope. In this situation, whatever clear zone width is not provided next to the pavement is supposed to be provided past the toe of the slope. This might involve removing trees or other obstacles that would constitute a hazard. Steepening the slope beyond the traversable condition also minimizes the wetland impacts even further. However, in this situation, the clear zone distance cannot be provided. If the slope is high enough and the traffic volumes and speeds great enough, then a guardrail is provided.

Guardrail is itself a hazard, and the key to providing guardrail is that the hazard of running off the road is greater than the hazard of striking the guardrail. For low-fill heights and low-volume roads, slopes steeper than 3:1 are often not protected with guardrail. I included a 2:1 slope as the most **desirable** steep slope to be provided. These slopes can be top-soiled and then tracked with dozers to provide a good seedbed, whereas steeper slopes cannot be tracked. Revegetation potential decreases and sedimentation/erosion potential increases with the steepness of the slope. Usually, 2:1 slopes fare pretty well in both categories.

The steepest fill slope is 1.5:1. This is close to the angle of repose for most earth materials which represents the limits of stability. While the wetland impacts are reduced even further, revegetation success and sedimentation/erosion can be problems on these slopes which may impact the wetland for a period of years. If the wetland contains deep, soft, unsuitable material, it will normally have to be subexcavated and replaced with sound material to adequately support the roadway above. This will temporarily impact additional wetland areas. If the wetland materials are salvaged and returned to cover the toe of the fill, the wetland should re-establish itself in the disturbed area.

Beyond 1.5:1 fill slopes, cost begins to become an important factor. Retaining walls can further minimize wetland impacts, but the question has to be asked, at what cost? Retaining walls range in price from $25 per square foot to $60 per square foot depending upon the height and type. In general, very special wetlands or conditions must be present to consider this type of solution.

Finally, just a few words about requests that always seem to come from resource agencies at stream crossings. The first preference is always a bridge, and the second is for an open-bottom arch culvert if a bridge cannot be provided. Bridges are expensive, ranging from $80 per square foot and up, and may or may not be appropriate depending on the site conditions. Design criteria and design life of the structure are much higher than for other elements of the project which contributes to a higher cost. For example, the design life for a bridge is usually 50 years, and it is hydraulically-sized to pass the 100-year flood with scour protection for the abutments of the structure. What appears on the surface to have a limited stream impact can be quite deceiving once the final hydraulic design is complete. A normal riprap blanket provided for scour protection of the abutments can totally wipe out the streamside vegetation that was to be preserved, or even disrupt the stream itself. The situation with an open-bottom arch is similar. In order to provide a stable structure, an adequate foundation must be provided that is protected from scour. Again, what appears on the surface to have a limited stream impact can be quite deceiving when the foundation design is complete. Except where solid rock is present very near the ground surface, the process of installing an adequate foundation below the stream scour depth will likely destroy the entire stream.

The policy in our organization is to limit the application of open-bottom arches to locations that have bedrock very near the surface. At other sites, we recommend a standard pipe-arch culvert with the invert of the pipe buried and backfilled with natural streambed materials. Baffles can be added inside the culvert depending on the grade of the stream and flow conditions to aid fish passage. This structure is much more economical than an open-bottom arch and is not subject to failure from scour.

In closing, I would just reiterate that avoidance and minimization of wetland impacts is a balancing act, dependent on many variables, including the personalities involved.   It is often challenging, but with cooperation we can still provide a safe, economical road and minimize wetland impacts at the same time.

ROAD SIGNS

How far you go in life depends on your being tender with the young, compassionate with the aged, sympathetic with the striving, and tolerant of the weak and the strong — because someday you will have been all of these.

- George Washington Carver

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Federal Highway Administration
610 E. Fifth Street
Vancouver, WA   98661